INFRASTRUCTURE NEEDS FOR WASTE MANAGEMENT

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Abstract

National infrastructures are needed to safely and economically manage radioactive wastes. Considerable experience has been accumulated in industrialized countries for predisposal management of radioactive wastes, and legal, regulatory and technical infrastructures are in place. Drawing on this experience, international organizations can assist in transferring this knowledge to developing countries to build their waste management infrastructures. Infrastructure needs for disposal of long lived radioactive waste are more complex, due to the long time scale that must be considered. Challenges and infrastructure needs, particularly for countries developing geologic repositories for disposal of high level wastes, are discussed in this paper.

1. INTRODUCTION

Considerable experience has been accumulated in processing, conditioning, transporting, storing, and disposing of low and intermediate level waste in the Organization for Economic Development and Cooperation/Nuclear Energy Agency (OECD/NEA) Member countries. The national infrastructures for management of this type of waste have been established to deal with such waste safely and economically. Drawing on this experience, the International Atomic Energy Agency (IAEA) has developed and is developing helpful guidance and is disseminating good practice to make this experience available to countries, which are just in the process of developing this infrastructure.

While most aspects of radioactive waste management for long lived waste, which includes vitrified high level waste and spent fuel, are available, the main current task is disposal of this type of waste. The nuclear community has been working on the development of the deep underground repository concept as a promising option, but there is no repository for this type of the waste in operation in the world. On the other hand there is no qualified alternative option to the disposal in underground repositories [1].

I would like to elaborate on the infrastructure needs for management of long lived waste in a broader sense, since a more dynamic approach is required to advance the development of underground repositories, due to their very long time scale, than for the one for low and intermediate level waste.

2. RECENT PROGRESS [2]

Geological disposal is not new. Underground repositories for low and intermediate level waste exist in Germany, Finland and Sweden. Since March 26 of this year, the first purposed-built deep underground geologic disposal facility has gone into operation in the USA. The Waste Isolation Pilot Plant (WIPP) in South Eastern New Mexico, takes military waste which contain significant long lived radioactive components and places it in caverns excavated at depth of 650 metres below ground in an embedded salt formation.

Thus, in most countries where radioactive waste management programmes are actually place, the basic infrastructure for interaction between regulators, implementers and decision makers is well established to proceed in societal, cultural and politically acceptable way. What is required for long lived waste would be adjustment to specific needs, taking account of its very long time scale.

Programmes for development of underground repositories for long lived waste are making progress towards this goal. In the USA, the Yucca Mountain project on a site in Southern Nevada has made progress toward an important decision making point. A comprehensive viability assessment went to congress in December 1998. In France, a decision was taken to build an underground laboratory on a candidate site for underground repository. In Finland, one local community has agreed to host a national repository, and a final siting decision should be made in the year 2000. In Sweden, it is planned to start the investigation of 2 sites within a few years into the 21st century.

Projects towards geologic disposal of high level waste have marked a considerable development status but have been recently interrupted, based on decision in which politics and public opinion played an important role. This has affected for example,. advanced projects in Canada, UK, Switzerland and Germany. That is one of the reasons why I consider that a dynamic approach for advancing repository development is necessary.

Recent experience is a sign of growing influence of the so-called non-technical stakeholders. This will pose a great challenge for the traditionally technology-centred waste management community not only to inform those stakeholders, but also to address and incorporate their concerns in their thinking and work [3].

3. CHALLENGES AND INFRASTRUCTURE NEEDS

The infrastructure for nuclear power programmes constitutes a framework of the one for waste management. Of course, general infrastructure for management of long lived waste is not necessarily different from the existing one for low and intermediate level waste [4]. Nevertheless, adjustment is necessary to address specific issues related to the management of long lived waste. Since we have a tendency to discuss so-called "hard" aspects of infrastructure, I would try to shed light on 5 major areas, what I will refer to as, the "soft" infrastructure.

(1) It is essential to increase technical confidence by carrying out field experiments, especially in underground laboratories. Such a laboratory is considered to be an important step to develop underground engineering and to collect invaluable data for testing of scientific and mathematical models used in safety assessments. More than 10 facilities provide opportunities for R and D work at locations that are not seen as repository sites, while a few others are located at potential deep repository sites. Some have acted as a centre for international co-operative research projects [2]. The laboratory can certainly address an emerging issue on the development and testing of engineered barriers. There is unanimous agreement that engineered barriers play an important role in the concept of robustness of a repository, by providing a high degree of long term containment through a combination of physical barriers and chemical controls.

(2) It is necessary to strengthen confidence in assessment, especially understanding the evolution process of geological media and repository, methods and data, taking into account future development. In recent years, improved scientific understanding has provided the means and instruments for a more realistic evaluation of the potential behaviour of geologic disposal systems. Consequently, while being aware of all shortcomings and limits of predictive theoretical modules, more confidence can be placed in up to date safety assessment technique [5]. Developments have also been made in techniques for promoting comprehensive consideration of relevant features, events and processes.

In addition, understanding has improved in assessing the role of different types of uncertainty, e.g. due to the lack of detailed knowledge of site specific data, and a method has been developed for handling these uncertainties. Thus, today there is more overall confidence that the result of assessments that employ such methods, model and data are a reliable basis for reaching acceptability of a repository site and design. International peer reviews, which the NEA has been providing, would be an additional measure to strengthen technical confidence. [6]

(3) The regulatory framework is the most decisive part of the waste management infrastructure. It is based on the experience which has been gained through the licensing process for facilities for disposal of low and medium level waste through review of safety studies and support of decision making at various stages of deep geological repositories. Regulatory guidelines are being reviewed which set out principles and specific requirements for underground disposal. Site–specific requirements have been set out in some countries and more detailed guidance are developed for demonstrating implementer's compliance with regulatory requirements. A process of regulator/implementer exchange of views has been established in many countries, including review of the implementer's researches activities, and iterative safety assessments. This process should be also seen as a complex network of regulators, implementers and decision makers to achieve different tasks and fill respective responsibilities, interacting with each other and their respective environment of political, economical and societal interests.

(4) Financial and liability aspects deserve special attention in view of the very long term risk implications. Funds for management of long lived waste have been collected and set aside for future needs in various forms in the NEA Member countries. The process of repository development is long, and the operation of a repository will probably last, at least, for 50 to 60 years. When considering the siting, construction and closing phases, the whole process could take us to 100 years. Then, the post closure phase follows. Under the current competitive environment, special considerations would be necessary to secure funds for long term financial and liability for management of long lived waste [7].

(5) The process for decision making requires additional attention since a variety of stakeholders are involved. The long duration of this process, the novelty and complexity of the task imply that detailed planning of the entire repository development process at the outset of a project is not possible. Although discrete stages can be defined at the outset, detailed planning must proceed iteratively as information and experience become available. A number of inter-dependent decisions must be taken throughout the planning, construction, operation, closure of the facility and post closure actions. The process also requires certain flexibility to allow planning and implementation to be responsive to new findings and to possible changes in the legal and regulatory framework of a country. A flexible approach means that alternative options are, where possible, continually reviewed and compared with the state of the art in geological disposal including long term surface storage, retrievability, and transmutation. On the other hand, in order to preserve credibility and confidence in this step-wise approach itself, there must be an understanding of what is to be broadly achieved at each step, and what would be required to make this step. Technical and scientific inputs can be also addressed in such an open discussion [8].

4. CONCLUSION

Based on technical achievements and experience in the management of short lived radioactive waste, as well as of non-radioactive waste, the community working on implementing geological disposal programmes has been clarifying the technical and non-technical infrastructure requirements for implementing geological disposal of long lived waste. But the confidence in the long term safety of geological disposal gained by experts is not necessarily shared by non-expert groups. There is widespread recognition, within the waste management community, that the critical path towards implementation of repository development programmes is increasingly determined by a broader community.

Some recent experience in major waste disposal programmes can be interpreted as an indication that existing infrastructures for waste disposal are not well equipped to deal with complex situations. This situation requires an integrated approach for giving attention to important but not technically finalised issues. In other words, there is a need of institutional mechanisms for integrating environmental, societal, economic and other factors into the decision making process.

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